

YARMOUTH WATER DEPARTMENT

99 BUCK ISLAND ROAD
WEST YARMOUTH, MA 02673

STANDARD DOCUMENTS FOR WATER MATERIALS AND INSTALLATION

AUGUST 2021

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SECTION 02222

EARTHWORK FOR WATER DISTRIBUTION SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

- A. In general the work of this Section shall include but not necessarily be limited to, excavation, trenching, filling, backfilling, compaction and grading for water distribution systems.

1.2 PROTECTION OF PROPERTY AND UTILITIES

- A. Extreme care shall be exercised to prevent damage to existing trees, shrubs, utilities, walls, sidewalks, fences and private property.
1. Any damage to these items as a result of work performed by the Contractor shall be repaired by the Contractor at his own expense.
 2. Existing property boundary markers, control points and datum elevation markers or bench marks shall be preserved.
 - a. All such items which are displaced or destroyed by the Contractor shall be replaced by a registered Engineer or Land Surveyor, as required, with all expenses paid by the Contractor.
- B. Utility agencies shall be contacted and advised of proposed work prior to the start of work by the Contractor.
1. Notify Dig Safe.
 2. Obtain information from the proper sources and authorities concerning locations of all utilities within the scope of this work.
 3. If and when encountered, utilities shall be supported and protected, and the Yarmouth Department of Public Works (DPW) shall be notified.
 - a. Ample time shall be allowed for entrance and taking such measures as may be required for the continuance of such services by the utility owner.
 4. Rules and regulations governing the respective utilities shall be observed.

1.3 REFERENCE STANDARDS

- A. The Contractor shall comply with the provisions of the following agencies as they apply to this project.
1. Associated General Contractors of America, Inc. (AGCA) "Manual of Accident Prevention in Construction."
 2. Occupational Safety and Health Administration, United States Department of Labor Requirements
 3. ANSI "Safety Regulations for Construction and Demolition".
 4. American Society for Testing & Materials (ASTM)
 5. American Water Works Association Standards
 6. Massachusetts Highway Department "Standard Specifications for Highways and Bridges"

1.4 SUBMITTALS

- A. Testing and Samples:
 - 1. Test reports on backfill materials, moisture density tests, in place density tests (ASTM D 1557 and D 1556).
 - 2. Representative backfill and bedding samples and gradation tests (ASTM D 422).

PART 2 MATERIALS

2.1 GENERAL

- A. Except as specified for pipe bedding, pipe cover, roadway subbase, and refill for rock and unsuitable materials, backfill materials may be as follows:
 - 1. Suitable materials for trench backfill shall be the material excavated during the course of construction, but excluding debris, pieces of pavement, frozen materials, organic matter, silt, top soil, ledge excavation and rocks over six inches in largest dimension.
 - 2. Gradation of material shall be generally as specified for gravel borrow except that maximum size of stone shall be 6 inches.
 - 3. The suitability of existing material for use as backfill will be determined by the Yarmouth Department of Public Works.

2.2 PIPE BEDDING AND COVER MATERIAL

- A. Ductile Iron Pipe:
 - 1. Gravel borrow shall be a granular material, well graded from fine to coarse, with a maximum size of 3 inches, obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted.
 - 2. It shall not contain vegetation, masses of roots, or individual roots.
 - 3. It shall be free from loam and other organic matter, clay, and other fine or harmful substances.
 - 4. Gravel borrow shall conform to requirements as specified in paragraph 2.05 herein.
- B. Plastic Pipe or Copper Tubing:
 - 1. Sand borrow shall consist of clean inert, hard, durable grains of quartz or other hard durable rock free from loam or clay, surface coatings and deleterious materials.
 - 2. The allowable amount of material passing a No. 200 sieve as determined by AASHTO shall not exceed 10 percent by weight.
 - 3. The maximum particle size shall be 3/8 inch.

2.3 CONCRETE SAND

- A. Concrete sand shall meet ASTM C-33 for fine aggregate.

2.4 STRUCTURAL FILL

- A. Structural fill shall generally range from gravelly sand to gravel, free of organic material, trash, loam, ice, snow, frozen soil and other objectionable material, and shall conform to the following:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
6 inch	100
No. 4	30-80
No. 40	5-35
No. 200	0-8

2.5 GRAVEL BORROW

- A. Gravel borrow shall be a granular material, well graded from fine to coarse, with a maximum size of 3 inches, obtained from approved natural deposits and unprocessed except for the removal of unacceptable material and stones larger than the maximum size permitted.
1. It shall not contain vegetation, masses of roots, or individual roots.
 2. It shall be substantially free from loam and other organic matter, clay, and other fine or harmful substances.
 3. Gravel borrow shall have the following gradation:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
3 inch	95-100
1/2 inch	50-85
No. 4	40-75
No. 50	8-28
No. 200	0-8

2.6 PROCESSED GRAVEL FOR ROADWAY BASE

- A. Shall meet the requirements of the Commonwealth of Massachusetts Department of Public Works Standard Specifications for Highways and Bridges, latest edition, M1.03.1.

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
3 inch	100
1 1/2 inch	70-100
1/4 inch	50-85
No. 4	30-60
No. 200	0-10

2.7 CRUSHED STONE (Hydrant Drains)

- A. Crushed Stone: Shall consist of durable crushed stone or durable crushed gravel stone, washed, free from ice and snow, stone dust, sand, clay, loam, or other deleterious material. The crushed stone shall be uniformly blended and conform to the following:

<u>Sieve Size</u>	<u>Percent Passing by Weight</u>
5/8 inch	100
1/2 inch	85-100
3/8 inch	15-45
No. 4	0-15
No. 8	0-5

PART 3 EXECUTION

3.1 TRENCH EXCAVATION

- A. The Contractor shall make all excavation in earth and in rock, necessary or incidental to the proposed construction under the terms of this Contract and as herein specified or indicated on the Drawings.
 - 1. All trench excavation shall be accomplished by open cut method.
 - 2. All excavation shall be made in such manner and to such widths as will give ample room for properly installing, constructing and inspecting pipe lines and structures they are to contain.
 - 3. The width of trenches shall be sufficient to allow thorough compacting of the refill adjacent to the lower quarters of the pipe. At pipe joints such additional width and depth shall be excavated as is necessary to give ample room for properly making and inspecting the pipe joint.
 - 4. Bracing and support of all trench excavation shall meet all requirements of Local and State ordinances and OSHA regulations.
 - a. Sheet piling and bracing, or the use of a steel support box shall be used where required to maintain a safe working condition and provide protection from collapse of the trench walls.
 - 5. During excavations, material determined by the Yarmouth Department of Public Works to be suitable for backfilling, shall be placed a sufficient distance from the banks of the trench to avoid slides or cave-ins. Unsuitable material shall be disposed of and replaced with surplus suitable material and gravel borrow to the extent necessary.
 - 6. Should conditions make it impractical or unsafe to place material along the trench, it shall be hauled and stored at a location provided by the Contractor. When required, it shall be re-handled and used in backfilling the trench. No additional compensation will be made for re-handling this material.
 - 7. Pipe trenches shall be backfilled as soon as practical after the pipes have been laid, jointed and inspected by the Yarmouth Department of Public Works. The extent of excavation open at any one time shall be no more than 50 linear feet of trench during working hours and no more than 20 linear feet during non-working hours.

3.2 EXCAVATION CLASSIFICATION

- A. Earth excavation shall comprise all materials not classified as rock excavation and shall include clay, silt, sand, muck, gravel, hardpan, loose shale, pavement, pavement bases, loose stone in masses and boulders measuring less than one cubic yard in volume.

3.3 TRENCH EXCAVATION IN PAVED ROADWAYS

- A. In excavating trenches in roadways with pavement, the Contractor shall cut the pavement twice; once prior to excavation and again prior to permanent resurfacing.
 - 1. The first cut may be made using a water cooled abrasive saw, pneumatic chisel or a wheel cutter attached to a front end loader.
 - 2. The second and final cut shall be made with a water cooled abrasive saw.
 - 3. In all cases a trial section shall be cut to indicate the performance of the equipment to be used.
 - 4. Pavement removed shall not be mixed with other excavated materials, but shall be disposed of away from the site of the work before the remainder of the excavation is made.
 - 5. Existing pavement and base course to remain shall be protected by the Contractor. All existing pavements and base courses which are to remain and have been damaged, shall be restored or replaced by Contractor to match existing pavements, base courses and grades, at no additional expense to the Yarmouth DPW.

3.4 UNSUITABLE MATERIAL

- A. All pipes and structures are to be laid on a stable foundation. If material at grade is determined to be unsuitable by the Yarmouth Department of Public Works, the Contractor shall excavate a further depth and/or width, and refill with an approved material at his own expense. Refill material shall be structural fill, gravel borrow or crushed stone as determined by the Yarmouth Department of Public Works.
 - 1. Where fine sand and silt are encountered at the bottom of the trench, it shall be the option of the Yarmouth Department of Public Works to require a 6-inch compacted depth of concrete sand meeting ASTM C-33 for fine aggregate to be installed beneath the pipe bedding to the full width of trench.

3.5 BACKFILLING AND COMPACTING

- A. Backfill shall be placed in uniform layers. Each layer shall be thoroughly compacted by tamping or vibrating with mechanical compacting equipment.
 - 1. Care shall be taken to compact the backfill materials throughout the full width of the excavation and beneath all pipes and structures.
 - 2. The backfilling of trenches shall proceed as soon as the laying of the pipe (s) or installation of the structures will allow.
 - 3. Pipe bedding shall be required below and up to the springline of all pipe.
 - a. Pipe bedding shall be placed to the full width of the trench and to a depth of 6 inches below the bottom of the pipe barrel as indicated on the Drawings.

4. Pipe bedding shall be placed 12 inches beyond the widths of a utility structure foundation (base) and to a depth of 6 inches below the foundation (base) or as indicated on the Drawings.
 5. After a pipe has been placed and bedded, the trench shall be filled to the centerline of the pipe with pipe bedding and compacted.
 - a. Material under and around the pipe shall be carefully and thoroughly compacted and tamped with approved compacting equipment.
 6. From the centerline of the pipe to a point 12 inches above the top of the pipe, the fill shall be pipe bedding.
- B. Placement of Backfill Above the Pipe Bedding
1. Above the pipe bedding, backfill shall be suitable material from the excavation or, if ordered by the Yarmouth Department of Public Works, gravel borrow.
 - a. This backfill shall be placed in layers 12 inches deep in loose measure, and each layer shall be thoroughly compacted.
 - b. This backfill shall be placed up to the bottom of materials specified to be placed for surfacing requirements.
- C. Roadway Trench
1. The following additions shall apply specifically to trenches within roadways:
 - a. The top twelve (12) inches of trench refill, roadway sub-base, shall be comprised of processed gravel furnished, placed, graded and compacted by the Contractor. This material shall be placed during the backfilling operation.
 - b. The Contractor shall fine grade the surface, apply dust control treatment and maintain the surface in a condition which will allow safe vehicular traffic until resurfacing is placed.
 2. The length of unsurfaced trench shall not exceed 500 linear feet, and shall be maintained to the Yarmouth DPW's satisfaction, in a condition to allow safe vehicular traffic.
 - a. If the trench is not maintained in a satisfactory condition, the allowable length of unsurfaced trench shall be reduced accordingly.

3.6 TRENCH SIZE

- A. Trenches shall be excavated to the necessary width and depth for proper laying of pipe and placement of concrete and other materials and shall have vertical sides to 12 inches above the pipe.
1. Widths of trenches shall provide 12 inches clearance between the sides of the trench and the outside face of the pipe.
 2. Maximum trench width (W) (to 12 inches above the pipe) for 12 inch nominal diameter and smaller pipe shall be 36 inches.
 3. Maximum payment trench width (W) (to 12 inches above the pipe) for pipes larger than 12 inches in diameter shall be the outside diameter of the pipe plus 24 inches.
 4. Above 12 inches over the pipe, the maximum trench width shall be as close to the above widths as installation requirements allow.
 5. The depth of trench shall be a minimum 6 inches below the pipe barrel, or 1/4 of the pipe diameter, whichever is greater.

3.7 STRIPPING TOPSOIL

- A. Topsoil shall be carefully stripped and separately stored to be used again for topsoiling and seeding on off-pavement areas within which excavations are to be made.

3.8 EXCAVATION NEAR EXISTING STRUCTURES AND UTILITIES

- A. It is called to the attention of the Contractor that there are utilities and other underground pipes along the course of the work. Information shown on the Drawings as to the location of said utilities and pipes is from the best available sources, but no guarantee is implied, nor is it to be assumed that such information is accurate or complete. Utility lines shall be crossed in the course of the work.
- B. The Contractor shall exercise special care during his operations to avoid injury to all such underground utilities and structures.
 - 1. When necessary, the Contractor shall cooperate with, and consult with representatives of the Yarmouth DPW and the utility companies in order to avoid damage to the utilities.
 - 2. The Contractor shall arrange for or furnish and erect suitable supports and shoring or other means of protection where required to protect the utilities, all at no additional cost to the Yarmouth DPW.
 - 3. Hand methods of excavating shall be used around buried utilities and is included in the work to be done under this Contract, at no additional cost to the Yarmouth DPW.

3.9 PROTECTION OF PROPERTY

- A. The Contractor shall, at his own expense, preserve and protect from injury all property either public or private along and adjacent to the line of work, and be responsible for and repair any and all damage and injury thereto, arising out of or in consequence of any act or omission of the Contractor.
 - 1. All existing pipes, culverts, poles, wires, fences, mailboxes, stone walls, curbs, bounds, etc., shall be temporarily removed, supported in place or otherwise protected from injury, and shall be restored to at least as good condition as that in which they were found immediately prior to the start of work.
 - 2. Lawns, shrubs, bushes, planting beds and decorative trees disturbed or damaged shall be restored to a condition equal to that found prior to the start of construction, either by temporary transplant or replacement in kind, except as otherwise indicated on the Drawings.

3.10 SAFETY AND ACCOMMODATION

- A. The Contractor shall provide, at his own expense, suitable bridges over trenches where required for the accommodation and safety of the traveling public, and provide facilities for access to private driveways for vehicular use.
 - 1. He shall erect suitable barriers around the excavation to prevent accidents to the public and shall place and maintain during the night, sufficient lights on or near the work.
 - 2. A space of twenty (20) feet shall be left so that free access may be had at all times to fire hydrants and proper precautions shall be taken so that the entrances to fire hydrants and fire stations shall not be blocked or obstructed.

3.11 DETOURS

- A. It is the intent of this Contract to keep the roadways open to two way traffic at all times. In order to obtain permission for the closing of the roadway, the Contractor shall satisfy the Yarmouth DPW, Police Chief and Fire Chief, that his operations will allow emergency access at all times.

3.12 UNIFORMED POLICE OFFICERS

- A. The Contractor shall make all arrangements with the local Police Chief and/or the State Police for the services of uniformed police officers.
 - 1. If, in the opinion of the State Police, Police Chief or the Yarmouth DPW, uniformed police officers are required for protection of persons and control of traffic, the Contractor shall be responsible for making all arrangements for said uniformed police officers as may be required.

3.13 COMPACTION REQUIREMENTS AND TESTING

- A. All backfill materials shall be thoroughly compacted by rolling, tamping or vibrating with approved mechanical or pneumatic compacting equipment so that pipe, structures, paving and other construction will not settle at the time of construction or in the future. The responsibility for thorough compaction is that of the Contractor irrespective of methods of backfill and depth of backfill layers placed.
- B. All percentages of compaction specified herein shall be of the maximum dry density at the optimum moisture content as established by Method D of AASHTO Standard T180 (ASTM D1557) (Modified Proctor) and verified by AASHTO Standard T147 (ASTM D 1556). When the term "thoroughly compacted" is used in these specifications, it shall mean compaction to at least 95% of the maximum density of the soils at optimum moisture content.
- C. The following numbers and types of soil tests shall be made where directed by the Yarmouth Department of Public Works. These tests shall be made by qualified personnel of an independent testing laboratory, acceptable to the Yarmouth Department of Public Works and paid by the Contractor.
 - 1. Particle-Size analysis of Soils and Backfill Materials in accordance with ASTM D422. A total of 5 satisfactory tests.
 - 2. Moisture-Density Relationship of soil in accordance with ASTM D1557, Method D. A total of 5 satisfactory tests.
 - 3. In-Place Density Tests of materials in accordance with ASTM D1556. One in- place density test shall be performed every 300 linear feet, or as directed by the Yarmouth Department of Public Works. Compaction tests will be taken at random on compaction layers below and at finished surfaces.
 - 4. Failed tests shall be repeated at the Contractor's expense.
- D. The Yarmouth Department of Public Works reserves the right to have additional compaction tests performed by an independent laboratory with testing costs borne by the Contractor, except that failed tests shall be repeated at the Contractor's expense.

E. If any of the field density test results fail to meet the density as specified herein for the earthwork involved, then the Contractor shall remove all of the earthwork in that portion of the work involved as determined by the Yarmouth Department of Public Works, and shall replace it in accordance with these Specifications to the required density.

1. Compaction shall be to the following densities:

<u>Fill and Backfill Location</u>	<u>Modified Proctor Density (Percent)</u>
Under structures and pipes	95
Beside structure foundation walls	95
Top two feet under pavements	95
Under pavements below top two feet	95
Trenches through unpaved areas	90
In embankment	90

F. Puddling and jetting of the backfill shall not be permitted except in special cases approved by the Yarmouth Department of Public Works.

3.14 TRENCH EXCAVATION IN FILL

A. Where the existing ground surface does not permit at least 4 feet of cover over the finished pipe, and where indicated on the Drawings, the Contractor shall place and compact suitable fill material to the depth necessary to provide the 4 foot minimum cover, including loam to a minimum top width of 6 feet, or as otherwise shown on the Drawings

1. Minimum side slopes shall be two horizontal to one vertical.
2. Fill material shall be from surplus suitable material or gravel borrow, and be clean, dry, and capable of satisfactory compaction, all as approved by the Yarmouth Department of Public Works, and shall be placed in layers not exceeding 8 inches thick and compacted.
3. The trench shall be excavated in the compacted fill and the remainder of the work shall be in accordance with other portions of these Specifications.

3.15 DISPOSAL OF SURPLUS AND UNSUITABLE EXCAVATED MATERIAL

A. All surplus excavated material and any material unsuitable for use shall be disposed of in disposal areas provided by the Contractor.

1. It is the Contractor's responsibility to dispose of unsuitable excavated material in an approved manner.
2. The Contractor shall not dispose of surplus materials on wetlands or other areas prohibited by the Corps of Engineers or the Commonwealth of Massachusetts Department of Environmental Protection, or any other local authority having jurisdiction.

3.16 CLEAN-UP

- A. The Contractor shall remove all surplus materials (earth, pipe, fittings, storage and office trailers, barricades, etc.), from the construction site.
 - 1. All paved roadways affected by the construction shall have their full width swept clean (paved edge to paved edge) using methods which control the dust.
 - 2. Before the Contractor may proceed to another roadway, cleanup of the previous roadway must be complete.

END OF SECTION

SECTION 02611

BURIED DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Furnish ductile iron water mains, fittings, and other appurtenances as required.

1.2 INSPECTION, TESTS AND ACCEPTANCE

- A. All delivered pipe shall be accompanied by test reports certifying that the pipe conforms to "AWWA Standard AWWA C151 for Ductile Iron Pipe, for Water and Other Liquids".
- B. All tests shall be made in accordance with the methods prescribed by the above mentioned AWWA Standard, and the acceptance or rejection shall be based on the test results.
- C. Pipe which does not conform to the requirements of this contract shall be immediately removed from the site and replaced by the Contractor with pipe which does conform.

1.3 STANDARDS

- A. The following American Water Works Association (AWWA) standards form a part of this specification as referenced:
 - 1. AWWA C104 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
 - 2. AWWA C110 Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In. for Water and Other Liquids
 - 3. AWWA C111 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
 - 4. AWWA C150 Thickness Design of Ductile-Iron Pipe
 - 5. AWWA C151 Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids
 - 6. AWWA C153 Ductile-Iron Compact Fittings, 3 In. through 12 In., for Water and Other Liquids

1.4 SUBMITTALS

- A. The Contractor shall submit shop drawings which shall contain the following for each type of pipe, fitting and coupling to be furnished:
 - 1. Manufactures' catalog cut.
 - 2. An exploded view diagram with a materials list.
 - 3. Performance characteristics with indication that it meets or exceeds the standards specified herein.
 - 4. Recommended spare parts list.

PART 2 PRODUCTS

2.1 PIPE

A. Ductile Iron Pipe

1. All pipe shall meet the requirements of ANSI/AWWA C151/A21.51 and ANSI/AWWA C150/A21.50.
2. Class: 52
3. Joints: Push-on meeting the requirements of ANSI/AWWA C111/A21.11.
4. Gaskets: Conform to ANSI/AWWA C111/A21.11.
5. Lining: Conforming to ANSI/AWWA C104/A21.4
6. Thickness of cement-mortar lining:
 - a. 1/8 inch for pipes 12 inches and smaller.
 - b. 3/16 inch for pipe 14 inches and larger.
7. Cement-mortar lining to be seal coated per AWWA C104/A21.4.
8. Machined surfaces shall be cleaned and coated with a suitable rust preventative coating at the shop immediately after being machined per AWWA A21.4.
9. Accessories: Pipe shall be provided with all necessary accessories to make-up the joint (glands, tee head bolts, hex nuts, brass wedges, etc.).
10. Pipe shall be manufactured in North America.

2.2 FITTINGS

A. Fittings

1. Comply with ANSI/AWWA C1110/A21.10.
2. Shall be ductile iron.
3. Pressure rating: 350 psi.
4. Lining and coating: Same as pipe.
5. Joint: Mechanical joint in compliance with ANSI/AWWA C110/A21.10.
6. Push-on and mechanical joint restraints shall be suitable for the specified pressure test and shall meet ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 current requirements.
7. Markings on fittings: Comply with ANSI/AWWA C110/A21.10.
8. Caps and plugs shall comply with ANSI/AWWA C110/A21.10.
9. Fittings shall be manufactured in North America.
10. Accessories: Fittings shall be provided with all necessary accessories (Lug style restrained accessory).

B. Hydrant Anchor Tees

1. Comply with ANSI/AWWA C153/A21.53.
2. Shall be mechanical joint locking type, each having a bell and plain end, with a split mechanical joint on the plain end.
3. Gate valve shall be secured directly to the tee by using the standard mechanical joint gasket and standard bolts.
4. Shall be manufactured in North America.

2.3 COUPLINGS

A. Transition couplings shall be as manufactured by Smith Blair (Model Omni 441), HyMax, Romac or an approved equal and shall have the following attributes:

1. Meets AWWA C219.
2. Sized to accept pipes of the material and diameter specified.
3. Ductile iron sleeve.

4. Buna N gaskets.
5. High strength low alloy steel bolts with heavy, semi-finished hexagon nuts to AWWA C219 standards.
6. Shall be manufactured in North America.

2.4 REPAIR CLAMPS

- A. Full Circle Repair Clamps
 1. As manufactured by Smith Blair (Model 226) or an approved equal.
 2. Stainless steel single band.
 3. High strength ductile iron ASTM A536 lugs.
 4. Buna N gasket.
 5. High strength low alloy steel bolts with heavy semi-finished hexagon nuts.
 6. Outer diameter range to accommodate pipe diameters and materials specified.
 7. Shall be manufactured in North America.
- B. Tapped Full Circle Repair Clamps
 1. As manufactured by Smith Blair, Mueller (Model No. 504 or 508) or an approved equal.
 2. Stainless steel single band.
 3. High strength ductile iron ASTM A536 lugs.
 4. Buna N gasket.
 5. High strength low alloy steel bolts with heavy semi-finished hexagon nuts.
 6. Outer diameter range to accommodate pipe diameters and materials specified.
 7. Stainless steel outlet integral to the band, with 1-inch or 2-inch CC threads.
 8. Shall be manufactured in North America.

2.5 INSULATION

- A. Shall be structurally strong, water tight and entirely resistant to corrosive elements.
- B. Interior insulation shall have the following physical characteristics:
 1. ASTM D1621 Minimum Density: 2.0 lb/cu ft
 2. ASTM C177 K Factor: 0.147 Btu-in/hr-sq ft-deg F
 3. ASTM D6226 90 to 95% Closed Cell
- C. Exterior casing shall be seamless, non-tape cast, HDPE complying with ASTM D1248. The exterior casing shall have the following physical characteristics:
 4. ASTM D638 Ultimate Elongation: 850%
 5. ASTM D638 Tensile Yield Strength: 3300 psi
 6. ASTM D3350 Resin Type III, Grade P34
 7. ASTM D790 Tangent Flexural Module: 175,000 psi

PART 3 EXECUTION

3.1 PIPE HANDLING

- A. The Contractor shall take care not to damage pipe by impact, bending, compression or abrasion during handling
- B. Pipe, fittings, and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such material be dropped. Pipe handled on skidways shall not be skidded or rolled

against pipe already on the ground. In distributing the material at the site of the work, each piece shall be unloaded opposite or near the place where it is to be laid in the trench.

- C. Pipe and fittings shall be so handled that the coating and lining will not be damaged. If, however, any part of the coating or lining is damaged it shall be immediately brought to the Yarmouth Department of Public Works' attention and repaired by the Contractor at his expense in a manner satisfactory to the Department of Public Works or a new pipe or fitting supplied.
- D. Gaskets shall be shipped in cartons and stored in a clean area, away from grease, oil, heat, direct sunlight and ozone producing electric motors.

3.2 PIPE CUTTING

- A. When cutting of pipe is required the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends to be used with a push-on type bell shall be beveled to conform to the manufacturer's spigot. Cement lining shall be inspected for damage and shall be remortared as required to ensure a continuous lining.

3.3 PIPE SUPPORTS

- A. The Contractor shall furnish and install all supports necessary to hold the piping and appurtenances in a firm, substantial manner at the lines and grades designed.
- B. Where required, bends, tees and other fittings in pipe lines buried in the ground shall be backed up with Class A concrete placed against undisturbed earth where firm support can be obtained. If the soil does not provide firm support, then suitable bridle rods, clamps and accessories to brace the fittings properly shall be provided. Such bridle rods, etc. shall be coated thoroughly and heavily with an approved bituminous paint.
- C. Concrete shall be comprised of domestic Portland cement conforming to ASTM C150, Type III.

3.4 LAYING PIPE AND FITTINGS

- A. Gasket type joints shall be made up by first inserting the gasket into the groove of the bell and applying a thin fill of special nontoxic gasket lubricant uniformly over the inner surface of the gasket which will be in contact with the spigot end of the pipe. The end of the plain pipe shall be chambered to facilitate assembly. The end shall be inserted into the gasket and then forced past it until it seats against the bottom of the socket.

3.5 INSTALLATION OF PIPE AND FITTINGS

- A. Each pipe and fitting shall be cleaned of all debris, dirt, etc., before being laid and shall be kept clean until accepted in the complete work.
- B. All pipe, fittings and appurtenances to be laid in open trench excavations shall be bedded in and uniformly supported over its full length. Pipes and appurtenances shall be bedded in Ordinary Borrow as specified in ANSI/AWWA C600, or as directed by the Director of Public Works or designee.

- C. Pipe and fittings shall be laid accurately to the lines and grades indicated on drawings submitted to and approved by the Yarmouth Department of Public Works. Care shall be taken to ensure alignment both horizontally and vertically, and to give buried pipe a firm bearing along its entire length. Pipe deflection shall not exceed the manufacturer's recommended maximum deflection.
- D. The minimum total of finished cover over the top of the barrel shall be 5 feet.
- E. Pipe shall not be laid in water, nor shall water be allowed to flow through them. The contractor shall take all necessary precautions to prevent flotation to the pipe in the trench.
- F. Backfilling of the pipe trench shall be done as specified under Section 230 and 300 of the Massachusetts Standard Specifications for Highways and Bridges as amended, and all other applicable Town Rules and Regulations.
- G. Ductile iron pipe installed within 5 feet of a gas line shall be fully encased in polyethylene material. Polyethylene shall be 8 millimeters thick and comply with ANSI/AWWA C105/A21.5-10.

END OF SECTION

SECTION 02640

BURIED VALVES AND APPURTENANCES

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work included: Furnish valves, valve boxes, and accessories, as required.

1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings which shall contain the following for each type of valve and appurtenant to be furnished:
1. Manufactures' catalog cut.
 2. An exploded view diagram with a materials list.
 3. Performance characteristics with indication that it meets or exceeds the standards specified herein.

1.3 STANDARDS

- A. The following American Water Works Association (AWWA) standards form a part of this specification as referenced:
1. AWWA C509/C515 Resilient-Seated Gate Valves for Water Supply Service.
 2. AWWA C504 Rubber-Seated Butterfly Valves

PART 2 MATERIALS

2.1 VALVES

- A. Resilient Seated Gate Valves:
1. Valves shall Type A2360 as manufactured by Mueller, AFC No. 2500 or an approved equal.
 2. Meet or exceed the requirements of ANSI/AWWA C509/C515.
 3. Joints: Mechanical joint conforming to ANSI/AWWA C111/A21.11.
 4. Cast iron/Ductile iron body.
 5. Bronze stem.
 6. Resilient sealed wedge type.
 - a. Wedge: Fully encapsulated; no exposed iron.
 7. Triple O-ring seal stuffing box.
 8. Non rising stem.
 9. Two (2) inch square operating nut.
 10. Rated for 200 psi and tested to 400 psi.
 11. Open: Counter-Clockwise (left).
 12. All internal and external surfaces except rubber coatings shall be coated with fusion bonded epoxy to a minimum thickness of 8 mils.
 - a. Coating shall be non-toxic, impart no taste to water and shall conform to AWWA C-550.
 13. Shall be manufactured in North America.

BURIED VALVES AND APPURTENANCES

2.2 TAPPING SLEEVE AND VALVE

- A. Tapping Sleeve:
1. As manufactured by Mueller Co. (H-304), AFC or approved equal.
 2. Size as specified.
 3. The tapping sleeves shall be the split sleeve, drop-in bolt design.
 4. Mechanical joint flange conforming to ANSI/AWWA C111/A21.11.
 5. Outlet flange dimensions and drilling shall comply with ANSI B16.1, Class 125 and with MSS SP-60.
 6. 304L Stainless steel body.
 7. Shall have a complete circle gasket on the interior of the shell. The gasket shall be composed of NBR virgin nitrile rubber and be of the waffle design. The gasket shall provide a complete 360° seal.
 8. Sidebars shall be heavy gauge 304 Stainless Steel, GTAW welded to form permanent fusion with shell.
 9. Certified to ANSI/NSF 61.
 10. O-ring seals on outlet and flange connections.
 11. Stainless steel nuts and bolts.
 12. Rated for 250 psi and tested to 400 psi.
 13. ¾ -inch NPT test plug.
 14. Shall be manufactured in North America.
- B. Tapping Valve:
1. As manufactured by Mueller Co., AFC or approved equal.
 2. Size as specified.
 3. Joints: Mechanical joint by flanged end.
 4. Comply with ANSI B16.1, Class 125 and with MSS SP-60.
 5. Cast iron/Ductile iron body meeting or exceeding the requirements of ASTM A126, Class B.
 6. Meet or exceed all applicable requirements of ANSI/AWWA C509 standards.
 7. Mechanical joint outlet in compliance with ANSI/AWWA C111 standard with accessories.
 8. Resilient seated.
 9. Two (2) inch square wrench nut.
 10. O-ring sealed stuffing box.
 11. Open: Counter-Clockwise (left).
 12. Non-rising stem.
 13. 1-inch NPT test plug.
 14. All internal and external surfaces except rubber coatings shall be coated with fusion bonded epoxy to a minimum thickness of 8 mils.
 - a. Coating shall be non-toxic, impart no taste to water and shall conform to AWWA C-550.
 15. Shall be manufactured in North America.
 16. With accessories.

2.3 VALVE BOXES

- A. Valve box with lid:
1. Manufactured in North America.
 2. Material: Cast iron top section, bottom section and lid.
 3. Drop lid shall be heavy duty cast iron (with a minimum weight of 13 pounds) and have the word "WATER" and an arrow indicating the

- direction of opening cast into the cover in raised letters.
4. Valve box barrel shall not be less than (5 ¼) inches in diameter.
 5. Shall be two (2) piece sliding type, providing a minimum overlap of six (6) inches and allow for 5 feet of bury.
 6. The lower section shall enclose the operating nut and stuffing box/gear box of the valve and shall have a minimum diameter of 8 inches.
 7. The box shall not transmit shock or stress to the valve.

B. Valve box riser:

1. Shall be Trumbull Industries 367-5030 to 367-5038 series, or equal.
2. Manufactured in North America.
3. Designed for sliding type 5 ¼ inch shaft valve box and to fit standard lid.
4. Size as specified.

PART 3 EXECUTION

3.1 HANDLING AND INSPECTION

- A. Care shall be taken to prevent damage to valves, and appurtenances during handling and installation. All materials shall be carefully inspected for defects in workmanship and materials.
- B. All operating mechanisms shall be operated to check their proper functioning, and all nuts and bolts checked for tightness. Valves which do not operate easily or are otherwise defective shall be replaced at the Contractor's expense.

3.2 INSTALLATION

- A. Generally, valves shall be set and aligned plumb, supported by a flat stone or solid concrete block, with the trench bottom being firmly compacted.
- B. Valve boxes shall be set centered and plumb over the operating nuts of all, direct burial valves. The top of each valve box shall be set to finished grade with at least 10-inches of overlap between the upper sections for future vertical adjustment.
- C. Valves, bolts and all other appurtenances shall be thoroughly cleaned and given a shop coat of asphaltum varnish.

END OF SECTION

SECTION 02645

HYDRANTS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work included: Furnish hydrants and hydrant accessories as required.

1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings which shall contain the following:
1. Manufactures' catalog cut.
 2. An exploded view diagram with a materials list.
 3. Performance characteristics with indication that it meets or exceeds the standard specified herein.
 4. Recommended spare parts list.

1.3 STANDARDS

- A. The following American Water Works Association (AWWA) Standards form a part of this specification as referenced:
1. AWWA C502 Dry-Barrel Fire Hydrants

PART 2 PRODUCTS

2.1 HYDRANTS

- A. Hydrants shall be Mueller Super Centurion A-423 only. The Town of Yarmouth has standardized on this product.
1. Barrel sections shall be 5 1/4 inch diameter.
 2. Five (5) foot six (6) inch bury.
 3. Two (2) 2 1/2 inch hose nozzles.
 4. One (1) 4 1/2 inch pumper outlet
 5. Replaceable brass or bronze nozzles.
 6. Breakaway flange.
 7. Mechanical joint shoe (fusion bonded inside and outside with 8 mil epoxy).
 8. Open counterclockwise (left).
 9. Be in full compliance with AWWA C502.
 10. Factory painted green with white bonnet and hubs.
 11. Each hydrant shall come completely assembled and include all gaskets, flanges, nuts and bolts required for installation.
- B. Hydrants shall conform to National Standard Specification sizes in threads and nuts. Caps shall have retainer chains and rubber gaskets.
- C. Each hydrant shall be served directly from the water main through an anchor tee, 6-inch valve and 6-inch lateral connection.

2.2 HYDRANT ACCESSORIES

- A. Extension Kit

1. Length as needed to meet finish grade or as specified.
 2. Sized for 5 ¼ inch hydrant.
 3. Shall include all necessary accessories to raise hydrant in increments of 6-inches including stem, barrel, stainless steel extension stem coupling, extension flange, o-rings, gaskets, bolts and nuts, pins and hydrant lubricating oil.
- B. Safety Flange Repair Kit
1. Sized for 5 ¼ inch hydrant.
 2. Shall include all components needed to restore hydrant to service including safety flange, gaskets, bolts and nuts, or-rings, couplings, hydrant lubricating oil and pins.
- C. Fire Hydrant Connector Pipe
1. Shall be "Gradelok" as manufactured by Assured Flow Sales, Inc., or equal.
 2. Shall be compact ductile iron, AWWA C153-ANSI A21.53, 350 PSI.
 3. Shall have an anchoring feature at both ends so that, when used with M.J. split glands, a restrained joint is provided.
 4. Shall be cement-lined in accordance with AWWA C104-ANSI A21.4.

PART 3 EXECUTION

3.1 HYDRANT LOCATIONS

- A. All hydrant locations shall be subject to field location approval by the Town of Yarmouth.

3.2 INSTALLATION

- A. Hydrant branch connections shall be properly restrained using grip-type joint restraints with thrust blocks.
- B. Thrust blocking shall be placed behind the shoe of the hydrants taking care not to block the drain outlets.
- C. The hydrant drainage pit shall be approximately three (3) feet in diameter and filled with compacted crushed stone. While backfilling additional crushed stone shall be placed to at least six (6) inches above the hydrant drain ports.
- D. After being thoroughly cleaned, all iron work set below ground shall be painted with two coats of asphalt varnish as specified in AWWA C504.
- E. The hydrant shall be set plumb and to proper grade and shall remain properly supported until it is backfilled.
- F. After the hydrant has been set, it shall be entirely draped with burlap and remain covered until the water distribution system has been accepted and put into service.

END OF SECTION

SECTION 02650

THRUST BLOCKS AND JOINT RESTRAINTS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work included: Provide thrust blocks and joint restraints as required.

1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings to the Department of Public Works which shall contain the following for each type of restraint to be furnished:
 1. Manufactures' catalog cut.
 2. An exploded view diagram with a materials list.
 3. Performance characteristics with indication that it meets or exceeds the standards specified herein.
 4. Recommended spare parts and accessory list.

PART 2 MATERIALS

2.1 JOINT RESTRAINTS

- A. Mechanical joint restraint shall be Megalug 1100 Series as manufactured by EBAA Iron, Inc., Eastland, Texas, Ford/Uniflange 1400 Series, US Pipe MJ Field Lok or an approved equal.
 1. Glands shall be manufactured of ductile iron conforming to ASTM A536.
 2. Heat treated to a minimum hardness of 370 BHN.
 3. Shall have a minimum working pressure of 350 psi for pipe diameters up to 16 inches with a minimum safety factor of 2:1.
 4. Twist-off nuts.
 5. Size as specified.
 6. Lugs contoured to resist point loading of pipe.
 7. With accessory kit.
 8. Shall be manufactured in North America.
- B. Ductile iron pipe shall have rubber-gasket push-on joint or rubber gasket mechanical joint. Rubber-gasketed joints shall conform to AWWA C111. Gaskets shall be SBR.

2.2 CONCRETE

- A. Concrete shall have a minimum concrete strength of 3500 psi after 28 days.

PART 3 EXECUTION

3.1 THRUST BLOCKS

- A. Concrete thrust blocks shall be provided at all hydrants and fittings.

1. The backs of thrust blocks shall be placed against undisturbed earth and the sides shall be formed.
2. Felt roofing paper shall be placed to protect pipe joints.
3. Concrete shall not be placed over bolts or nuts.

3.2 JOINT RESTRAINTS

- A. Mechanical joint restraint devices shall be installed at all fittings in accordance with the manufacturers written instructions.

END OF SECTION

SECTION 02660 SERVICE CONNECTIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Work included: Furnish potable water service connections as required.

1.2 SUBMITTALS

- A. The Contractor shall submit shop drawings which shall contain the following:
1. Manufactures' catalog cut.
 2. An exploded view diagram with a materials list.
 3. Performance characteristics with indication that it meets or exceeds the standards specified herein.
 4. Recommended spare parts list.

1.3 STANDARDS

- A. The following Standards form a part of these Specifications as referenced:
1. AWWA C800 Undergroud Service Line Valves and Fittings.
 2. ASTM B-88 Type K Copper Tubing
 3. AWWA C901 Standard for Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. (13 mm) Through 3 In. (76 mm), for Water Service

PART 2 PRODUCTS

2.1 GENERAL

- A. All materials shall be manufactured in North America.
- B. The Yarmouth Department of Public Works has standardized on the following products listed in this Section for service connections.
- C. Any brass part of fittings or valves in contact with potable water shall be made of a "Lead Free" brass, defined as CDA Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA C-800. "Lead Free" brass alloy shall contain no more than twenty-five one hundredths of one percent (0.25%) total lead content by weight.

2.2 SERVICE TUBING

- A. Plastic Tubing
1. Comply with AWWA C901, ASTM D3350 and D2737.
 2. "Copper sized" outer diameter.
 3. Tracing wire shall be attached to the outside of the piping not incorporated into the plastic piping.
 4. Blue color, HDPE, SDR9, and have a minimum working strength of 200 psi, 600 psi bursting strength.
 5. Single piece without breaks or couplers up to 500 linear feet.
 6. Fittings for plastic pipe shall be waterworks brass-compression style meeting or

- exceeding AWWA C800. Compression joints shall provide watertight seal up to 300 psi. Setscrew compression joints shall not be allowed.
7. All valves on plastic tubing must be accompanied by stainless steel insert stiffeners.
 8. Shall be manufactured in North America.

B. Copper Tubing

1. Conform to ASTM B-88.
2. Type K annealed (soft).
3. Minimum diameter of 1-inch.
4. Seamless.
5. Shall be manufactured in North America.

2.3 CORPORATION STOPS

- A. Corporation Stop: Shall be as manufactured by Mueller Co. model H-15008 or H-15013, or approved equal.
1. Comply with ANSI/AWWA C800-89 (ASTM B62 – Index 115 85-5-5-5) and the latest revisions thereto.
 2. Any brass part of the corporation in contact with potable water shall be made of a "Lead Free" brass, defined as CDA Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA C-800. "Lead Free" brass alloy shall contain no more than twenty-five one hundredths of one percent (0.25%) total lead content by weight.
 3. Cast alloy "lead free" brass body.
 4. One piece cap and stem
 5. Ball type with ball full opening to provide maximum flow capacity and ease of turning.
 6. Integral checks for 90 degree rotation only.
 7. Double O-ring seals.
 8. 300 psi working pressure.
 9. AWWA taper thread for inlet and CTS compression end(s) (Mueller type) at outlet.
 10. Not inverted Key.
 11. Positive shut off.
 12. Quick style connections.
 13. Open Counter Clockwise (Left).
 14. Shall be manufactured in North America.

2.4 CURB STOPS

- A. Curb Stops for use with CTS tubing shall be as manufactured by Mueller Co.; Plug type, (Model No. B-25209 (no drain) and H-15219 (with drain)), or an approved equal.
1. Comply with ANSI/AWWA C800 (ASTM B62 – Index 115 85-5-5-5) and the latest revisions thereto.
 2. Any brass part of the curb stop in contact with potable water shall be made of a "Lead Free" brass, defined as CDA Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA C-800. "Lead Free" brass alloy shall contain no more than twenty-five one hundredths of one percent (0.25%) total lead content by weight.
 3. Cast alloy "Lead Free" brass body.

4. One piece closed-bottom body.
 5. Free turning plug type with low friction thrust washer for ease of turning.
 6. Integral checks for 90 degree rotation only.
 7. Top and port O-ring seals.
 8. 300 psi working pressure.
 9. Compression end(s) (Mueller type) for CTS OD tubing.
 10. Integral tee head and plug.
 11. Positive shut off.
 12. Open Counter Clockwise (Left).
 13. Shall be manufactured in North America.
- B. Curb Stops for use with iron pipe thread shall be as manufactured by Mueller Co.; Plug type, (Model No. H-10283 (no drain) and H-10284 (with drain)), or an approved equal.
1. Comply with ANSI/AWWA C800 (ASTM B62 – Index 115 85-5-5-5) and the latest revisions thereto.
 2. Any brass part of the curb stop in contact with potable water shall be made of a "Lead Free" brass, defined as CDA Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA C-800. "Lead Free" brass alloy shall contain no more than twenty-five one hundredths of one percent (0.25%) total lead content by weight.
 3. Cast alloy "Lead Free" brass body.
 4. One piece closed-bottom body.
 5. Free turning plug type with low friction thrust washer for ease of turning.
 6. Integral checks for 90 degree rotation only.
 7. Top and port O-ring seals.
 8. 300 psi working pressure.
 9. Iron pipe (FIP) thread on both ends
 10. Integral tee head and plug.
 11. Positive shut off.
 12. Open Counter Clockwise (Left).
 13. Shall be manufactured in North America.

2.5 CURB BOXES

- A. Curb boxes shall be as manufactured by Bibby Ste-Croix or an approved equal.
1. Two (2) piece slide type with one (1) piece lid.
 2. Lid shall have a minimum weight of 1.4 pounds.
 3. Six (6) foot/five and one half (5 ½) foot bury with arch pattern base.
 4. Buffalo style.
 5. Shall be manufactured in North America.
 6. Extensions shall be Bibby Ste-Croix V225 or V228 or equal.
- B. Curb Box Telescoping Top Riser
1. Shall extend to 12-inches with ring.
 2. Shall be manufactured in North America.

2.6 METER PITS

- A. Meter pits for 1" and smaller meters shall be as manufactured by Mueller Co. Adjusta-Coil Meter Box, or equal.
1. 1" meter or dual meter boxes shall be 18 inches in diameter.
 2. 5/8" or 3/4" meter boxes shall be 15 inches in diameter.
 3. Adjustable box depth.
 4. Meter inlet type shall be lockwing angle ball valve (reduced port).

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5. Outlet type shall be meter coupling.
 6. No bottom.
 7. Center locking device.
 8. Shall include a 4-inch insulating pad at diameter matching the diameter of the pit, equal to Mueller Pad 790022 for 15" diameter pits or 790153 for 18" diameter pits.
 9. Shall include a flat lid with center mounted pentagon nut lock with frame, equal to Mueller Lid 780068 for 15" diameter pits or 780069 for 18" diameter pits with frame equal to Muller Lid Frame 700097.
- B. Meter pits for 1-1/2" and 2" meters shall be as manufactured by Mueller Co. EZ-Vault Meter Setter, or equal.
1. 1-1/2" meter boxes shall be 24 inches in diameter.
 2. 2" meter boxes shall be 27 inches in diameter.
 3. Adjustable box depth.
 4. Meter inlet type shall be lockwing angle meter stop.
 5. Outlet type shall be meter coupling.
 6. No bottom.
 7. Shall include a 4-inch insulating pad at diameter matching the diameter of the pit, equal to Mueller Pad 790058.
 8. Shall include a flat lid with side mounted standard water works pentagon nut lock, equal to Mueller Lid 282925 with frame equal to Muller Lid Frame 700098.
- C. Meter setter box extensions shall be made from the same material and have the same wall thickness as the pit that it is set on, equal to Mueller SE series extensions.

2.7 SERVICE SADDLE

- A. Service saddles shall be double band or double strap type with a ductile iron body conforming to ASTM A-536, Grade 65-45-12 as manufactured by Smith-Blair S317 ore equal.
1. Threaded opening shall be CC (AWWA C800).
 2. Finished epoxy coat of 10 mils minimum.
 3. Bolts, nuts and washers shall be type 304 (18-8) stainless steel.
 4. Gaskets shall be virgin NBR compounded for water and sewer service.
 5. Straps shall be type 204 (18-8) stainless steel with coated threads to prevent galling.
 6. Shall be rated for 200 psi working pressure.
 7. Shall be manufactured in North America.

2.8 BALL VALVES

- A. Ball Valves shall be Apollo 70LF, or equal
1. Shall include handle.
 2. Any brass part of the ball valve in contact with potable water shall be made of a "Lead Free" brass, defined as CDA Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA C-800. "Lead Free" brass alloy shall contain no more than twenty-five one hundredths of one percent (0.25%) total lead content by weight.
 3. C89836 lead free bronze body.
 4. RPTFE Seats and stuffing box ring.
 5. Chromium plated ball.
 6. FIP ends.
 7. Open Counter Clockwise (Left).
 8. Shall be rated for 600 psi cold working pressure.
 9. Shall be manufactured in North America.

2.9 ANGLE METER VALVES

- A. Angle meter stops shall be Mueller Co. catalog number B-24258, or equal.
 - 1. Shall include angle or straight lever handle.
 - 2. Any brass part of the angle meter valve in contact with potable water shall be made of a "Lead Free" brass, defined as CDA Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA C-800. "Lead Free" brass alloy shall contain no more than twenty-five one hundredths of one percent (0.25%) total lead content by weight.
 - 3. Cast alloy "Lead Free" brass body.
 - 4. BUNA-N seat.
 - 5. Stainless steel reinforced seat o-ring.
 - 6. Fluorocarbon coated ball.
 - 7. Compression end for CTS O.D. tubing by FIP.
 - 8. Open Counter Clockwise (Left).
 - 9. Shall be rated for 300 psi working pressure.
 - 10. Shall be manufactured in North America.

2.10 SERVICE BRASS FITTINGS

- A. Any brass part of the service fittings in contact with potable water shall be made of a "Lead Free" brass, defined as CDA Copper Alloy No. C89520 or C89833 in accordance with the chemical and mechanical requirements of ASTM B584 and AWWA C-800. "Lead Free" brass alloy shall contain no more than twenty-five one hundredths of one percent (0.25%) total lead content by weight.
- B. Three Part Unions
 - 1. Shall have compression connections for CTS O.D. tubing on both ends and be equal to Mueller Co. H-15403N.
- C. Straight Coupling
 - 1. Straight coupling shall have compression connection for CTS O.D. tubing by iron pipe (FIP) thread or compression connection for CTS O.D. tubing by male iron pipe (MIP) thread or equal to Mueller Co. H-15451N or H-15428N, respectively.
- D. Pack Joint Coupling
 - 1. Pack joint straight coupling shall have pack joint connection for iron pipe by iron pipe thread and be equipped with a setscrew. Equal to Mueller Co. H-14233-10N (female) or H-15423-10N (male).
- E. Y Branch Connection
 - 1. "Y" branch connection shall be copper flare nut for the inlet and iron pipe thread for the outlet and be equal to Mueller Co. H-15342N.

PART 3 EXECUTION

3.1 HANDLING

- A. The Contractor shall take care not to damage pipe by impact, bending, compression or abrasion during handling and installation.
- B. Tubing which is kinked shall not be installed.

3.2 INSTALLATION

- A. General
 - 1. Minimum cover from finish grade shall be 5 feet.
 - 2. Installed a minimum of ten (10) feet from any sewer.
 - 3. Where a water service passes through a foundation wall or floor slab, the service shall be installed in a PVC sleeve extending through the foundation wall.
 - 4. Tubing shall be laid perpendicular to the water main and to the property line.
 - 5. Service saddle shall be used as required by the Town of Yarmouth. Any connection made to an asbestos concrete (AC) or plastic water pipe shall be tapped with a saddle.

- B. Plastic Pipe
 - 1. Piping shall be bedded and surrounded by 12-inches of sand.
 - 2. Tracing wire shall be exposed at ground level at the curb box and through the building foundation.
 - 3. Blue magnetic traceable marking tape with a minimum 2-inch width shall be installed 12 inches above the complete plastic water service line.
 - 4. Pipe shall be attached and anchored to copper piping before attachment to the water meter.

- C. Curb Stops and Boxes
 - 1. Place valve box over stop, taking care that it is installed plumb.
 - 2. Curb stops shall be key checked after adjustment of curb box to final grade. If curb stop is not centered in the box the box shall be removed and reset over the curb stop.

END OF SECTION

SECTION 02675

DISINFECTING WATER MAINS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Disinfecting water mains and their appurtenances, as required.
- B. The procedure for disinfecting water mains, as described in this section, generally consists of the following steps:
 - 1. Flushing the new water mains.
 - 2. Filling the new water mains with chlorinated water.
 - 3. Disinfecting the new water mains with chlorine solution.
 - 4. Flushing the chlorinated water from the new water mains.
 - 5. Taking samples for bacteriological analysis.
 - 6. Testing the samples at a state certified laboratory.
 - 7. Placing the new water mains into service.

1.2 SUBMITTALS

- A. The Contractor shall prepare a plan for disinfecting water mains and their appurtenances that describes the proposed schedule, the location of all sampling and flushing points, and the overall procedure for disinfecting. The plan shall also present the proposed chemicals to be employed, the strength of the chemicals and the equipment employed to apply them. The plan shall be presented to the Department of Public Works for review not less than two weeks prior to the proposed time for disinfecting the water mains.
- B. Copies of all test results, as specified herein, shall be submitted directly to the Water Superintendent from the laboratory that conducted the tests.

1.3 STANDARDS

- A. The following standards are referenced, in part, in this specification:
 - 1. Specific sections, or portions thereof, of AWWA C651 (latest revision) Disinfecting Water Mains, as further described herein.

1.4 COST OF DISINFECTING WATER MAINS

- A. All costs associated with disinfecting water mains, including water, chemicals and bacteriological analysis of samples, as further described in this Section, shall be paid for by the Contractor.

PART 2 MATERIALS

2.1 WATER

- A. Water for flushing of water mains, preparation of chlorine solutions and filling of water mains for disinfection shall be potable drinking water.

2.2 CHEMICALS

- A. Chlorine for preparation of chlorine solutions for disinfection shall be sodium hypochlorite or calcium hypochlorite and shall conform to the requirements of ANSI/AWWA B300.
- B. Chlorine solutions shall be neutralized prior to disposal using sodium bisulfite, sodium sulfite or sodium thiosulfate.

2.3 WATER SAMPLE BOTTLES

- A. Sterile water sample bottles shall be obtained from a state certified laboratory.
 - 1. Sterile bottles for bacteriological analyses shall be treated with sodium thiosulfate to neutralize any residual chlorine.
 - 2. Two samples are required at each specified sampling point. One sample shall be analyzed for the presence of coliform bacteria and one sample shall be analyzed for the presence of heterotrophic plate count (HPC) bacteria.

PART 3 EXECUTION

3.1 WATER MAIN DISINFECTING

- A. After completion of all water main related construction, except water service connection installation, all water mains, valves, hydrants, hydrant connections and other appurtenances installed under this Contract shall, be disinfected in accordance with AWWA Standard C651, Section 4.4.3 (Continuous Feed Method), as modified herein.
 - 1. All existing hydrants and valves shall be operated by Yarmouth Water Department personnel only. The contractor is not permitted to operate Town owned hydrants and valves.
 - 2. Taps for flushing, chlorination and sampling shall be installed by the Contractor at no additional expense to the Town of Yarmouth.
 - 3. Flush the new water mains with potable water to remove any contaminants and debris that may have entered the water mains during construction.
 - 4. The flushing velocity in the new water mains shall not be less than 2.5 feet per second. In the absence of a flow meter, flow rate shall be determined either by placing a pitot gage at the discharge or by measuring the time to fill a container of a known volume
 - 5. Prepare a chlorine solution that will be continuously fed into the potable water that is used to fill the new water mains.
 - 6. The chlorine solution shall be applied to the new water mains with a chemical feed pump designed to feed chlorine solutions.

7. Completely fill the new water mains with the chlorinated, potable water to remove any air pockets. The point of application shall be no more than 10 feet downstream from the beginning of the new water mains.
8. The chlorine solution shall be of sufficient strength to provide a minimum residual chlorine concentration of 25 milligrams per liter (mg/l) in the filled water mains.
9. New valves and hydrants shall be operated to insure their proper disinfection.
10. Isolation valves shall be maintained in a closed position to prevent chlorinated water from entering the existing water distribution system.
11. Chlorinated water shall remain in the main for a minimum of 48 hours.
12. The minimum residual chlorine concentration at the end of the 48 hour holding period shall be 10 mg/l.
13. After the 48-hour retention period, chlorinated water shall be flushed from every hydrant branch on the main until the chlorine concentration leaving the main is no higher than that generally in the system or less than 1.0 mg/l.
14. Chlorinated water shall be discharged in a manner that will not adversely affect flora and fauna or drainage courses and shall conform to applicable State regulations for waste discharge.
15. Chlorinated water that is flushed from the mains shall be neutralized by the addition of a dechlorinating agent so that the residual chlorine concentration is zero.
16. The location of the discharge for the dechlorinated water shall be approved by the Department of Public Works.

3.2 BACTERIOLOGICAL TESTS

- A. A minimum of 48 hours after flushing and before the new water mains are placed in service, the Contractor shall collect two water samples 24 hours apart for testing of the bacteriological quality of the water.
 1. No hose or fire hydrant shall be used in the collection of samples.
 2. A sampling tap shall consist of a standard corporation stop installed in the main with a PVC gooseneck assembly.
 3. Samples for bacteriological testing shall be collected in sterile bottles treated with sodium thiosulfate and furnished by the state certified laboratory that will perform the tests.
 4. A private company specializing in this field shall chlorinate the main, take the samples and have the same tested by an approved laboratory.
 5. Unless otherwise directed by the Department of Public Works, the minimum number of samples for bacteriological analysis shall be as follows:
 - a. One sample every 1,000 linear feet of newly installed water mains.
 - b. One sample at the end of the newly installed water mains.
 - c. One sample at each branch.
- B. All bacteriological tests shall be performed by a state certified laboratory.
 1. Two bacteriological tests shall be performed on all samples:
 - a. one coliform bacteria, and
 - b. one heterotrophic plate count (HPC) bacteria.
 2. Test results on all samples and a copy of the chain of custody shall be mailed directly to the Yarmouth Water Department from the laboratory.
 3. The disinfection procedure shall be considered satisfactory only if the results of all tests confirm the following:
 - a. the absence of coliform bacteria in all samples taken and
 - b. the HPC bacteria are 50 or less colony forming units per milliliter (cfu/ml) in all samples taken.
 4. The new water mains may be placed in service if the results of the disinfection

DISINFECTING WATER MAINS

- procedure are satisfactory and the Water Department has granted permission.
5. If the initial disinfection procedure fails to produce satisfactory results, the new water mains shall be flushed and resampled as described above. If the test results from the resampling also fail to produce satisfactory results, the entire disinfection procedure shall be repeated.

END OF SECTION

SECTION 02676
TESTING WATER PIPING
SYSTEMS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Work Included: Provide pressure/leakage tests as required.

1.2 STANDARDS

- A. The following American Water Works Association Standard shall form a part of this specification as referenced:
1. AWWA C600 Installation of Ductile Iron Water Mains and Their Appurtenances.

PART 2 PRODUCTS

2.1 WATER

- A. The Department of Public Works shall furnish water free, for flushing and testing the water main, if hydrants or other connection points are convenient to the work. Otherwise, the Contractor shall be responsible for securing an acceptable potable water supply at no additional cost to the Town of Yarmouth.

PART 3 EXECUTION

3.1 TESTING

- A. A formal pressure/leakage test shall be required of the water mains, valves and appurtenances in the system constructed.
1. The pressure/leakage test shall be conducted in accordance with these specifications and the applicable requirements of AWWA C600, Section 4.
 2. Where any section of a water main is provided with concrete thrust blocks, the test shall not be made until at least 5 days have elapsed since the concrete was placed.
 3. If high-early-strength cement is used in the concrete thrust blocks, the test shall not be made until at least 2 days have elapsed since the concrete was placed.
 4. Prior to testing, the pipe line or section thereof, the section to be tested shall be thoroughly flushed, and all air expelled. All air shall be expelled by appropriate methods including the use of corporation stops installed by the Contractor, at no additional cost to the Department of Public Works, at high points along the water main.
 5. After all the air has been expelled, and the corporation stops closed, the test pressure shall be applied by means of a pump connected to the pipe.
 6. The pump, pipe connections, and all necessary apparatus including the gages, shall be furnished by the Contractor.
 7. Unless otherwise specified the test pressure shall be 150 psi or 150 percent of the working pressure, whichever is greater, but in no case shall the pressure exceed 250 psi.

8. This pressure shall be maintained for 2 hours.
9. Any excessive indicated leakage, as determined by the pressure test, shall be located and repairs made. The total leakage from the pipeline or sections thereof shall not exceed the amount shown in Table 1 of this Specification Section in accordance with AWWA standards.
10. Should the pipe line or sections thereof not come within the permissible leakage limits, the Contractor (at his own expense) shall be required to excavate and locate the source of leakage and make repairs.
11. After the Contractor has notified the Yarmouth Water Department that repairs have been made, the test shall be repeated until the pipeline or sections thereof are within the allowable leakage.

Table 1

Ductile and Gray Cast Iron mains
Allowable Leakage per 1000 Ft.

Avg. Test Pressure (psi)	<u>Nominal Pipe Diameter (inches)</u>						
	<u>6</u>	<u>8</u>	<u>10</u>	<u>12</u>	<u>16</u>	<u>20</u>	<u>24</u>
350	0.84	1.12	1.40	1.69	2.25	2.81	3.37
300	0.78	1.04	1.30	1.56	2.08	2.60	3.12
250	0.71	0.95	1.19	1.42	1.90	2.37	2.85
200	0.64	0.85	1.06	1.28	1.70	2.12	2.55
150	0.55	0.74	0.92	1.10	1.47	1.84	2.21
100	0.45	0.60	0.75	0.90	1.20	1.50	1.80

* Leakage allowable based on gallons per hour per 1000 feet of main.

END OF SECTION